

Artificial Intelligence and the Future of Patentability: Navigating Innovation and Inventorship in the Digital Age

Peter Budai

Research assistant, Data Vision Global, Hungary

Corresponding Author: peter.budai@datavisionglob.com

Abstract

The rapid evolution of Artificial Intelligence (AI) is fundamentally transforming innovation and creativity, reshaping the principles of patent law and inventorship. Traditional patent systems were designed for human inventors, but AI's increasing role in generating novel ideas, designs, and processes challenges the boundaries of intellectual property frameworks. This paper explores how AI impacts patent eligibility, ownership, and disclosure, and examines international responses to AI-generated inventions. It also investigates ethical and legal dilemmas arising from autonomous creation, focusing on accountability, transparency, and fairness in the recognition of inventorship. Through a comparative analysis of legal frameworks, this study proposes policy recommendations to ensure that patent law evolves in parallel with technological innovation, balancing innovation incentives with equitable recognition of creative contributions in the digital age.

Keywords: Artificial Intelligence, Patentability, Inventorship, Intellectual Property Law, Innovation Policy, Autonomous Invention, Legal Ethics

I. Introduction

Artificial Intelligence (AI) has transcended its initial boundaries as a computational tool to become a powerful creator and innovator. From designing novel drug compounds to generating optimized mechanical designs and writing complex code, AI is increasingly assuming roles traditionally occupied by human inventors. Reimagining DMCA immunity in the generative AI era involves redefining intermediary liability to reflect the blurred distinction between content host, creator, and algorithmic processor[1]. This transition poses profound challenges to

established notions of patentability and inventorship. Patent systems, rooted in the assumption that invention is an act of human ingenuity, are now confronted with the reality that autonomous or semi-autonomous systems can produce patentable outputs with minimal human input. The resulting tension between technological advancement and legal frameworks necessitates a comprehensive reevaluation of patent laws worldwide[2].

Historically, patent systems were established to encourage innovation by granting inventors exclusive rights to their creations for a limited period. The reward structure assumes human creativity, intentionality, and accountability — concepts that are not easily applicable to machines. When an AI system like DeepMind’s AlphaFold predicts protein structures, or when DABUS (Device for the Autonomous Bootstrapping of Unified Sentience) generates new container designs, the central question becomes: who owns these inventions? Is it the AI’s programmer, the user, or the AI itself? Courts and patent offices around the world have largely rejected the idea of recognizing AI as an inventor, maintaining that inventorship requires a natural person. However, these decisions only postpone the inevitable confrontation between legal orthodoxy and technological reality[3].

The international patent community remains divided. Jurisdictions such as the United States, the European Union, and Japan have resisted granting inventorship status to AI systems, while South Africa became the first country to grant a patent naming an AI as an inventor. This global inconsistency underscores the urgency of harmonizing patent laws in light of AI’s growing role in innovation ecosystems. Moreover, the issue extends beyond ownership; it touches on transparency in the inventive process, accountability for errors, and the ethical implications of delegating creativity to machines[4].

As AI continues to evolve, its capacity to learn, adapt, and generate new solutions without explicit programming will intensify. Consequently, policymakers, scholars, and technologists must collaboratively redefine inventorship standards and develop adaptive legal frameworks. The future of patent law will depend on how effectively it can balance human oversight with machine autonomy, ensuring that the principles of fairness, innovation, and public benefit remain intact in the age of artificial intelligence[5].

II. Rethinking Inventorship in the Age of AI

AI's ability to autonomously generate ideas has blurred the boundaries between human and machine creativity. The traditional definition of an inventor as a "natural person who conceives an invention" becomes inadequate when the inventive act originates from algorithmic processes rather than human cognition. This issue gained global prominence through the DABUS case, which challenged patent offices in multiple jurisdictions to recognize an AI as an inventor. While South Africa accepted the AI's inventorship claim, most major economies rejected it, citing the absence of human mental conception. Collaborative protection underscores the shift from mere compliance-driven enforcement to a proactive model of shared responsibility and cooperative governance[6]. Yet these decisions raise philosophical questions about the nature of creativity itself: if an AI independently devises a novel solution, does denying it inventorship undermine the fundamental purpose of patent law—to reward and disclose innovation?

In the current legal landscape, inventorship remains tethered to human agency, primarily for reasons of accountability and moral responsibility. Patents entail obligations such as disclosing the invention, ensuring novelty, and defending against infringement claims—duties that AI cannot fulfill. However, the solution may lie not in rigid exclusion but in adaptive interpretation. Legal scholars have proposed a "derived inventorship" model, wherein the human entity responsible for training or operating the AI could be recognized as the de facto inventor. This framework maintains human accountability while acknowledging AI's creative input[7].

Furthermore, distinguishing between human-assisted and AI-generated inventions is increasingly difficult. Modern AI systems can produce designs without direct human intervention, yet such inventions often stem from human-defined parameters. The challenge lies in delineating the threshold of human contribution necessary for inventorship. Without legal clarity, innovation risks stagnation, as companies and researchers may hesitate to invest in AI-driven R&D amid uncertainty about ownership and patent eligibility. Therefore, establishing clear guidelines for AI-assisted inventorship is essential for sustaining innovation in the digital era[8].

III. Patentability Criteria and the Role of Disclosure in AI-Generated Inventions

Patentability depends on three key criteria—novelty, inventive step, and industrial applicability. AI complicates each of these principles. For instance, determining the novelty of an AI-generated invention becomes challenging when the AI model trains on vast datasets, potentially incorporating pre-existing knowledge. Similarly, assessing the inventive step—traditionally understood as the result of human ingenuity—becomes problematic when the “inventive process” involves opaque algorithmic decisions[9].

One of the central issues is explainability. AI systems, particularly those based on deep learning, often operate as “black boxes,” making it difficult to trace how an invention was conceived. Patent law, however, requires a clear and enabling disclosure of the invention’s process to allow replication. If the AI’s reasoning cannot be fully explained, can the resulting output still qualify for patent protection? Legal scholars suggest expanding the concept of disclosure to include the architecture, training data, and parameters of the AI system itself, thereby ensuring transparency and reproducibility. Yet this raises concerns over trade secrets, data privacy, and proprietary information[10].

Another dimension of AI patentability is the question of inventiveness. If AI can generate a vast number of potential solutions rapidly, does that diminish the value of each individual invention? Some experts argue for introducing a “human-centric filter,” recognizing only those inventions involving a degree of human input in defining the problem or interpreting results. This approach preserves the balance between technological efficiency and human creativity, ensuring that patents continue to incentivize meaningful innovation rather than automated generation[11].

As global patent offices grapple with these issues, harmonizing standards will be crucial. International organizations such as WIPO have initiated discussions to align AI-related intellectual property policies. A consistent global framework is essential to prevent forum shopping, promote innovation, and maintain fairness in international trade. The success of such efforts will determine whether AI serves as a catalyst for equitable innovation or becomes a

source of legal fragmentation. Figure 1 represents conceptual model illustrating how patentability criteria and disclosure transparency determine recognition of AI-generated inventions:

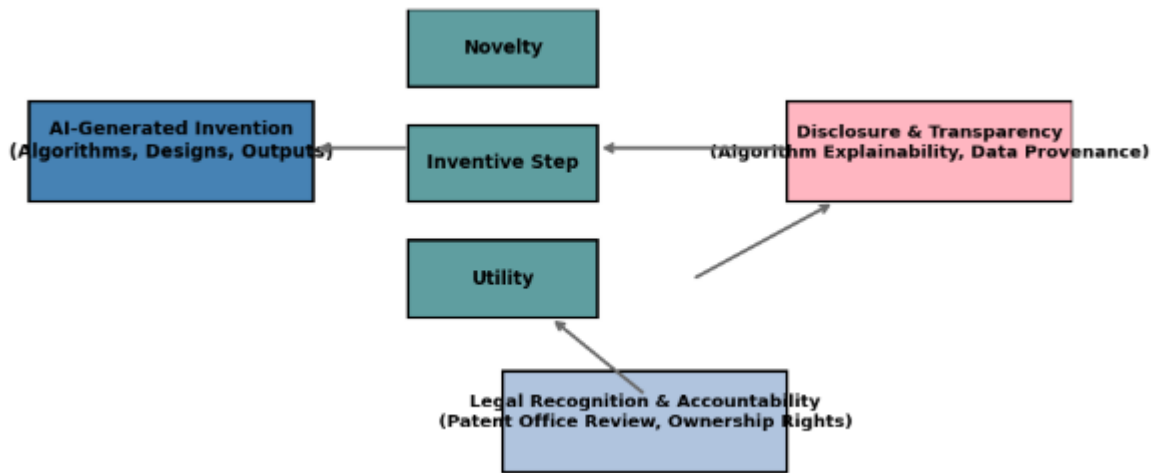


Fig 1: Patentability Criteria and the Role of Disclosure in AI-Generated Inventions

IV. Ethical, Economic, and Policy Implications of AI-Driven Patent Systems

Beyond legal challenges, the rise of AI-driven inventions introduces complex ethical and economic considerations. If AI-generated outputs are denied patent protection, companies may resort to trade secrets, reducing transparency and slowing scientific progress. Conversely, granting patents too freely could lead to monopolization by entities controlling powerful AI systems, stifling competition and limiting access to innovation. Policymakers must navigate these competing interests carefully to foster both openness and incentive. Collaborative protection of intellectual property emphasizes the collective responsibility of governments, industries, and society to create a coherent and sustainable framework for safeguarding innovation[12].

Ethically, the question of recognition extends to fairness and attribution. While AI lacks consciousness or moral agency, the humans behind its creation—data scientists, engineers, and users—play crucial roles. Equitably distributing credit among these contributors remains a

challenge, particularly in collaborative, multi-agent AI environments. Additionally, there are broader societal implications: automating creativity could redefine human labor markets, displacing traditional inventors and transforming innovation into a computational process dominated by a few technology conglomerates[13].

To address these issues, policy reforms must prioritize inclusivity, transparency, and accountability. Establishing AI registries for traceable inventorship, mandating algorithmic disclosure standards, and fostering open-source innovation ecosystems could help democratize access to AI-enabled creativity. Ethical frameworks, similar to bioethics in medical research, may guide responsible AI innovation. Ultimately, the goal should not be to humanize AI but to humanize innovation—to ensure that technological progress continues to serve humanity's collective good[14].

V. Conclusion

Artificial Intelligence has irreversibly transformed the innovation landscape, challenging the very foundations of patent law and inventorship. As AI systems gain autonomy and creative capacity, legal frameworks must evolve to reflect this new reality. The future of patentability depends on finding a balance between rewarding human oversight and acknowledging machine contributions, while preserving ethical integrity, transparency, and fairness. Through international cooperation and adaptive policymaking, societies can ensure that AI-driven innovation remains both legally sustainable and socially beneficial in the digital age.

References:

- [1] Y. Lin and T. Guan, "From safe harbours to AI harbours: reimagining DMCA immunity for the generative AI era," *Journal of Intellectual Property Law & Practice*, vol. 20, no. 9, pp. 605-616, 2025.
- [2] A. Abulibdeh, E. Zaidan, and R. Abulibdeh, "Navigating the confluence of artificial intelligence and education for sustainable development in the era of industry 4.0: Challenges, opportunities, and ethical dimensions," *Journal of Cleaner Production*, p. 140527, 2024.

- [3] H. Allam, J. Dempere, V. Akre, D. Parakash, N. Mazher, and J. Ahamed, "Artificial intelligence in education: an argument of Chat-GPT use in education," in *2023 9th International Conference on Information Technology Trends (ITT)*, 2023: IEEE, pp. 151-156.
- [4] L. E. Alvarez-Dionisi, M. Mittra, and R. Balza, "Teaching artificial intelligence and robotics to undergraduate systems engineering students," *International Journal of Modern Education and Computer Science*, vol. 11, no. 7, pp. 54-63, 2019.
- [5] N. G. Camacho, "The Role of AI in Cybersecurity: Addressing Threats in the Digital Age," *Journal of Artificial Intelligence General science (JAIGS) ISSN: 3006-4023*, vol. 3, no. 1, pp. 143-154, 2024.
- [6] T. Guan, "Collaborative Protection of Intellectual Property," *University of Pennsylvania Journal of International Law*, vol. 46, no. 2, p. 341, 2025.
- [7] L. Ghafoor and M. Khan, "A Threat Detection Model of Cyber-security through Artificial Intelligence."
- [8] Q. He *et al.*, "Can Large Language Models Understand Real-World Complex Instructions?," in *Proceedings of the AAAI Conference on Artificial Intelligence*, 2024, vol. 38, no. 16, pp. 18188-18196.
- [9] Z. Huma, "Deep Learning Demystified: Architectures, Applications, and Open Problems," *Euro Vantage journals of Artificial intelligence*, vol. 2, no. 2, pp. 72-78, 2025.
- [10] M. Khan and M. Lulwani, "Inspiration of Artificial Intelligence in Adult Education: A Narrative Overview," *OSF Preprints*, vol. 12, pp. 23-35, 2023.
- [11] B. Namatherdhala, N. Mazher, and G. K. Sriram, "Artificial intelligence trends in IoT intrusion detection system: a systematic mapping review," *International Research Journal of Modernization in Engineering Technology and Science*, vol. 4, 2022.
- [12] T. Guan, "Collaborative Protection of Intellectual Property: The Case of China," *U. Pa. J. Int'l L.*, vol. 46, p. 341, 2024.
- [13] H. Yang, L. Wang, J. Zhang, Y. Cheng, and A. Xiang, "Research on edge detection of LiDAR images based on artificial intelligence technology," *arXiv preprint arXiv:2406.09773*, 2024.
- [14] W. Tong, A. Hussain, W. X. Bo, and S. Maharjan, "Artificial intelligence for vehicle-to-everything: A survey," *IEEE Access*, vol. 7, pp. 10823-10843, 2019.